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Climate, aggression, and violence (CLASH): a cultural-evolutionary approach

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The **CL**imate, **A**ggression, and **S**elf-control in **H**umans (CLASH) proposes that aggression and violence increase as climates become hotter and seasonal variation becomes smaller by influencing time-orientation and self-control. Emerging empirical evidence supporting the model is reviewed. Wealth, income inequality, and pathogen stress as powerful influences of these processes are also discussed. We conclude by discussing the theoretical and societal importance of climate change in shaping violence.

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Over the past decade, climate has been increasingly recognized as a ubiquitous factor in shaping human behavior (for an overview see Ref. [1•]). Likewise, the empirical relationship between climate and violence has been demonstrated in many settings; from domestic violence in India [2] and Australia [3], assaults and murders in the USA [4] and Tanzania [5], ethnic violence within Europe [6], to civil conflicts throughout the world [7]. As a general trend, violence increases as climates become hotter [8••; see also 9–11]. Importantly, the effects are stronger for temperature than for other climate variables (*e.g.*, rainfall), and stronger for intergroup conflict than for interpersonal conflict. How can we understand such trends?

Most psychological theories focus on either hot weather as a primarily aversive stimulus that triggers aggression [12], or on the notion that people are more likely to meet face-to-face during warmer weather where aggression is likely to unfold [13]. Heat is a feature of both weather (temporary heat) and climate (average heat). Although weather and climate are closely related concepts, there are two important distinctions between them. First, weather changes continuously and is subject to unpredictability; climate has been extraordinarily stable, and seasonally predictable for thousands of years. Climate provides an annual overview of what can be expected in terms of weather per season and even smaller time-intervals. This includes predictable differences per season. In the words of the popular aphorism, 'climate is what you expect, weather is what you get.' Second, weather tends to have immediate physiological and psychological effects in the shorter run and at the individual level of human functioning; climate tends to have psychological and sociological effects in the longer run and at the societal level [14••].

CLimate, Aggression, and Self-control in Humans Model (CLASH)

In a recently published *Behavioral and Brain Sciences* target article, we proposed a new model of **CL**imate, **A**ggression, and **S**elf-control in **H**umans (CLASH) [15••] that transcends the effects of weather by offering a cultural-evolutionary explanation for how differences in aggression and violence can be understood in terms of differences in climate. The key climatological variables that influence aggression and violence are average heat and especially the broad influence of seasonal variation in heat (small or large annual differences within a location). Although average temperature and seasonal variation in temperature are confounded variables, at least on our planet – the warmer a climate in terms of mean temperature the less variability in seasonal temperature ($r = -.788$) (MI Rinderu, unpublished data) – it is the latter feature that should logically (in terms of the model) be predictive of future-orientation, self-control, and the degree to which these inhibit aggression and violence.

As alluded to earlier, and as will be discussed in greater detail later, climates create cultures. One key assumption of CLASH is that people at higher latitudes closer to the icecaps adapt to colder temperatures, and especially greater seasonal variation, by developing cultural customs characterized by a greater future-orientation, and an enhanced self-control (*Proposition 1*). The rationale behind this adaptation can easily be illustrated. Consider a fictional farmer with a limited to supply of seeds. In a climate that is too cold to grow crops for part of the year,

does he eat them all, or does he save some to plant next season's crop? [16]. From a purely climatological view, seasonal variation, along with its own set of adaptive problems (*e.g.*, food shortage in the winter months), is predictable; and therefore largely 'controllable.' We do not mean that climate (or weather) can be controlled (disregarding human impact on global climate change), but rather that (assuming cultures' historical roots from when most people were subsistence farmers) climatic survival in colder and seasonal varying conditions calls for the development of a culture of anticipation, foresight, and long-term planning (*e.g.*, plan for next season), and self-control (*e.g.*, not to consume all the harvest directly, but to harvest for later; see Ref. [17]). As a consequence, over many generations, this may well have led to cultural adaptation such as people focusing more on the future than the present, and exerting more self-control[4] (for an overview of research on time and cultures, see Ref. [18•]).

The CLASH model further outlines that future-orientation and self-control are important determinants of inhibiting aggression and violence, and therefore plausible mediators of the effects of average and seasonal variation in temperature on aggression and violence (*Proposition 2*). Much evidence shows that aggression and violence often start when self-control stops [19–24]; and that lack of self-control is one of the 'strongest known correlates of crime' [25], especially violent crime [26]. Likewise, an abundance of research has demonstrated the empirical relationships between greater future-orientation and less aggression and violence [27–32].

In short, CLASH maps out a conceptual pathway marked by latitude that begins with climates' influence on aggression and violence, leading from greater seasonal variation – much colder winters with somewhat hotter summers – to less aggression and violence; with future-orientation and self-control being conceptualized as mediators.

Support for CLASH

As a theoretical model, CLASH is quite new. It should therefore be no surprise that there are not many empirical tests of CLASH. However, there is some empirical evidence to support its propositions. First, research findings speak not only in favor of CLASH, but also in favor of extensions of CLASH by other socio-economic variables such as wealth. Research shows that heat stability ($r = .339$) and economic poverty ($r = .651$) are both positively relate to societal aggression (p's $< .001$). Furthermore, on the one hand, the impact of heat on aggression is not a direct effect, but one that is mediated by poverty. On the other hand, the impact of poverty on aggression is slightly modified by heat, with greater poverty at higher levels of heat being associated with lower levels of aggression, which remain nevertheless high as compared to levels of aggression in richer regions. These findings were robust across 124-northern hemisphere countries, and 43-southern hemisphere countries; suggesting both the generalizability of the findings across hemispheres and the importance of the equator as a biogeographic divide [33].

Second, research shows that a country's latitude (taken as the midpoint of the country) predicts homicide rates within the Northern hemisphere (accounting for 10% of the variance in homicide) with closer proximity to the equator linked to higher homicide rates; however the relationship does not hold in the Southern hemisphere [34]. More research is needed to see why CLASH would be true only for certain parts of the world as there is also some evidence that CLASH is not supported in Russia ([35]; for a full discussion of possible reasons, see our response article [36••]). Here we want to acknowledge the additional possibility of population density as the large majority of the world's population lives in the Northern hemisphere. For example, studies show that higher levels of density and crowding have been associated with higher levels of aggression [37,38], but also with behaviors corresponding to greater future-orientation [39]. In other words, there may be an interesting balancing dynamic between ecologically triggered behaviors and culture, with societal norms emerging to keep individuals in check.

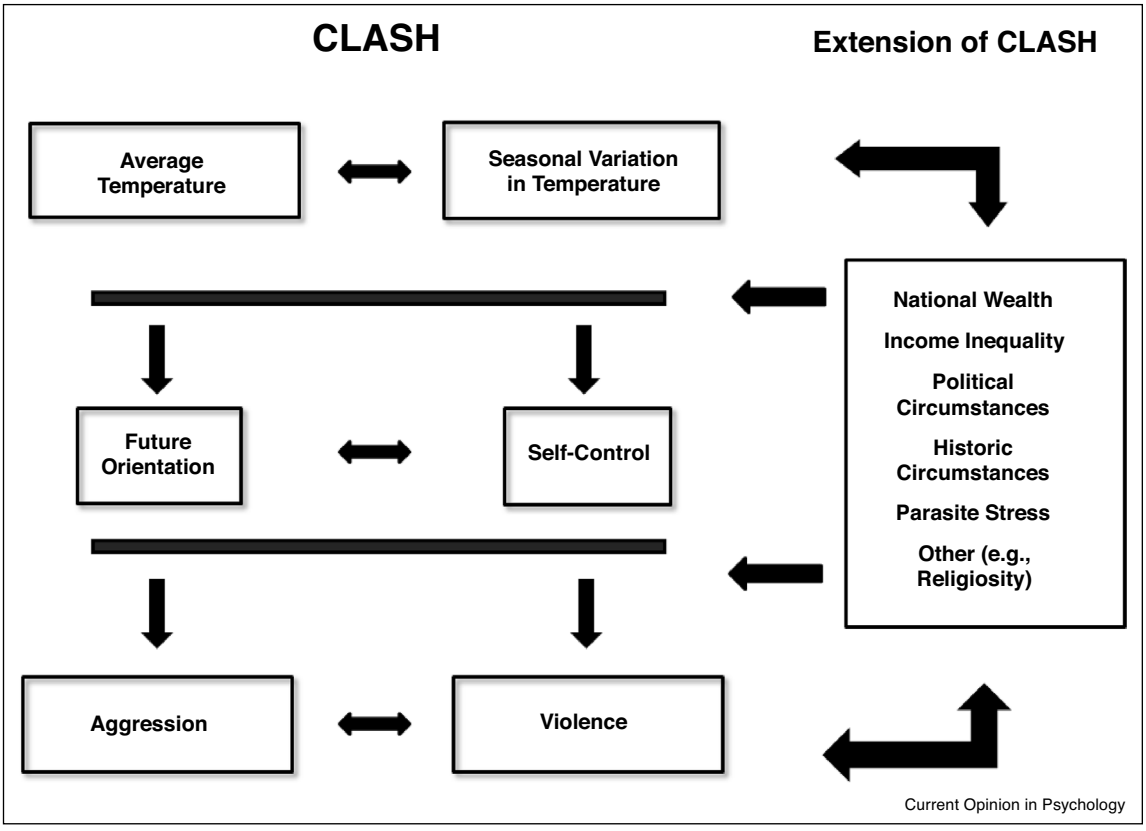
Third, CLASH has received some support from research on bullying, defined as 'an aggressive goal-directed behavior that harms another individual within the context of a power imbalance' [40]. Across 40 European and North American countries, research shows that the prevalence of bullying amongst adolescents increases with greater proximity to the equator (as ranked by 10-degree latitude bands) [41]. Also, as bullying is defined as a power imbalance, researchers found that worldwide power distance increases as countries become closer to the equator, which in turn was associated with higher homicide rates across countries. Furthermore, power distance was strongly and positively related to annual average temperature, and negatively (however marginally significant) related to seasonal variation [42]. Overall, the available evidence provides preliminary support for CLASH.

Extensions of CLASH

Virtually no conflict has a single cause. Indeed, CLASH acknowledges that other variables influence aggression and violence. CLASH assumes that climate itself might trigger intergroup hostility and aggression, and that these may well be influenced by variables such as wealth, income inequality, and parasite stress (see Figure 1 which also acknowledges more extensions, such as religiosity; see also our response article [36••]).

[4] Both future-orientation and self-control are intrinsic parts of slow life history strategies. For an application of CLASH to Life History Theory, see Ref. [15••].

Figure 1



A schematic model of CLASH (adapted from Ref. [15••]) and its extensions.

One key idea is that climate in combination with national wealth (Gross Domestic Product, or GDP) is essential to understanding the roots of aggression and violence, as argued by the **Climate-Economic Theory of Freedom** [43••]. Money can protect people against climatic hardships primarily through purchases of climate-compensating goods (*e.g.*, clothing, shelter, heating or cooling systems). Moreover, money enables people to engage in behaviors inspired by a future-orientation (*e.g.*, save money for the future becomes an option). Poverty also tends to be highest near the equator, where it is the hottest and where there is little seasonal variation [44–46].

As alluded to earlier, national wealth is strongly linked to climate. In turn, national wealth is strongly linked to income inequality—the richer the country, the less income inequality it tends to have ($r = -.44$) [47]. Above and beyond climate, income inequality is likely to exert direct effects on aggression and violence through a variety of different mechanism, from escalating social tensions [48] to simply increasing the economic returns to criminal activity [49]. Regardless of the mechanism(s) behind, much evidence shows that income inequality is one of the most powerful predictors of (typically male-perpetrated) aggression and violence [50–53].

Another key idea is that aggression and violence toward out-group members are deeply rooted in climate-related environmental circumstances: the threat of parasites. **Parasite-Stress Theory of Sociality** argues that humans adapt to parasite stress by adopting a stronger emphasis on differentiating between in-group and out-group members ([54], see also Refs. [55,56]). Recalling Burke *et al.*'s findings, this might help explain why violence, especially intergroup violence, increases as climates become hotter [8••]. Indeed, studies show that parasite stress promotes both interpersonal aggression and violence (*e.g.*, homicide, child maltreatment [57]), and intergroup conflict (*e.g.*, intrastate armed conflict and civil war [58]).

Simultaneously, Parasite-Stress Theory of Sociality might help explain proximal influences of physical warmth on trust and prosocial behavior [59,60]. A strong sense of 'out-group hate' may sometimes go hand in hand with some 'in-group love.' Thus, heat-induced aggression and violence do not exclude prosociality or closeness. It is possible that warmth is predictive of intergroup hostility, but with a simultaneous tendency to help those that belong to the in-group, tend to be similar to the self, or are otherwise psychologically close.

The above discussion shows that a complex of associations amongst climate and socio-cultural variables may lead to violence. There are many complications in this field—not at least, identifying cause and effect, and dealing with 'bad controls' (*i.e.*, variables that are plausibly themselves influenced by climate [8••], such as wealth). CLASH explicitly recognizes that climate can be a powerful cause of socio-economic and political/historical circumstances. But the reverse causal relationship is less true: these 'broad' cultural variables do not exert strong, direct effects on local climate (except human impact on global climate change which involves a longer-term increase in the average temperature in the world). Therefore, climate is an important causal agent in shaping culture, such as how individuals and groups develop and enforce norms against aggression and violence.

How do climates create cultures?

There is no question that life in the vegetable and animal world has adapted to its climatic context. It is, therefore, reasonable to assume that humans as 'cultural species' [61, p. 3] did so too. The argument put forward by CLASH is that colder climates with greater seasonal variation shape a culture of foresight and planning. This culture of foresight and planning may bring about a broader cultural 'package,' which includes traits such as future-orientation and self-control that societies pass onto next generations [17].

Given today's technological advancements that enables people to migrate to other climates, or to control climate by building temperature-controlled 'cities' (*e.g.*, people nowadays ski in Dubai), it becomes important to ask the obvious: Does CLASH still hold today?

The development of agriculture is the most profound cultural innovation in human history. As many humans were farmers until recently, it is reasonable to assume that agriculture dominates even today a society's culture and behavior. Indeed, research shows that agriculture does more than feed the world, it also influences our psychology, despite that nowadays most people earn their living in other ways [62•].

Similarly, CLASH assumes cultures' historical roots from when most people were subsistence farmers. Even in modern societies, we may see numerous examples of planning that is shaped by climate: saving of salt and sand throughout the year to defrost the roads during freezing weather conditions, the seasonal cycles in clothing, the organization of sports and other activities inside and outside, and of course, the planning of agriculture and farming (*e.g.*, preparing before and after the winter, harvesting in the summer and fall, storing food for the cattle in the winter).

Remaining issues: only temperature?

Climate is more than temperature and its variation. Culture is viewed here as a complex adaptation to numerous climate variables, including precipitation, wind, humidity, distance from the ocean and so on. Although studies on violence have addressed distinct climate variables, such as rainfall [63], drought [64], and the El Niño Southern Oscillation [11], CLASH focuses on temperature and its variation as the predominant dimension of climate because it has the largest effect on violence by far; at least four times as strong as the effect of rainfall for example (see Ref. [8••]). Also, a thermal climate seems to matter more for cultural adaptation than a precipitational climate [14••].

Climate change

Worldwide studies have supported the empirical relationship between climate and violence [8••,9–11]. A better understanding of this relationship is urgently needed when considering what is probably the biggest threat humanity faces today: 'the hot breath of our civilization' (McEwan cited in Ref. [65, p. 8]) that is global warming. Integration of the findings with temperature projections by the Intergovernmental Panel on Climate Change has predicted worrisome increases in violence levels around the globe by the end of this century [4,9]. Conflicts caused by climate change will continue to increase the salience of in-groups. For example, one group of researchers found that thinking about the threat of climate change causes people to behave more aggressively toward outgroups [66]. Understanding the roots of aggression and violence is one of the most important steps to reduce hostility and conflict, and to promote trust and cooperation between 'we' and 'them'; in a world that is getting smaller and smaller—and hotter and hotter.

Conflict of interest

Nothing declared.

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